Chapter 11
Final Site Plan or Map Production

11-1. Purpose

This chapter provides general guidance on preparing final site plan maps from topographic survey data acquired in digital format in the field. Different methods of transferring data into CADD and GIS platforms are described.

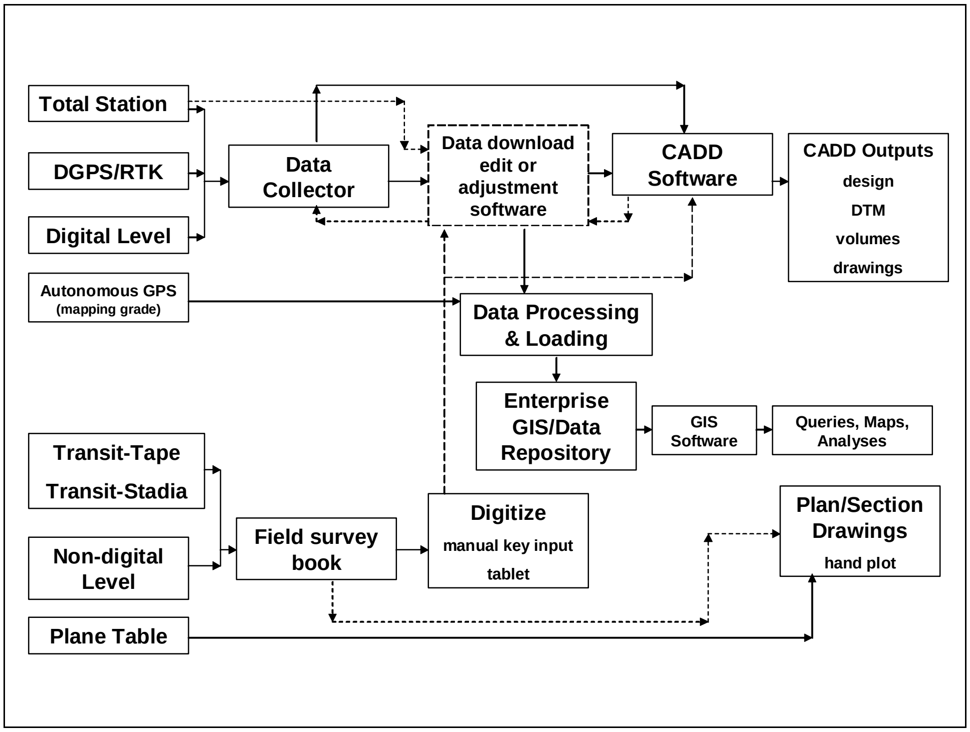


Figure 11-1. Overview of survey data flow

11-2. Overview of Topographic Survey Data Flow

Figure 11-1 above outlines the various routes by which topographic data are processed into a final site plan map format. As indicated in the figure, a number of processing options exist, depending on the software.

a. Field instrument and data collector. The field survey instrument may have an internal or external data collector. Total stations can export internal data directly to a processing software package, without going through an external data collector. GPS/RTK units typically record to an external data collector. Manual data collection is recorded in a field book which must be reduced by hand. If a digital file is desired, field book data must be manually keyed into a software program. A plane table survey obviously is field-finish system in which a final drawing containing planimetric features and contours is generated directly in the field.

b. Data download, editing, and adjustment software. Intermediate data download, edit, and adjustment software may be required for some data collectors. GPS data may require processing at this stage, using software such as Trimble TGO. Total station data is usually downloaded to an office PC using software compatible with that used on the data collector. TDS SurveyPro is an example of this type of software. Depending on the input format of data from the collector (*.raw, *.cr5, etc.), the software may have to create an X-Y-Z coordinate file from the raw data observations. Feature and attribute editing may also be performed at this stage. In addition, feature libraries can be backloaded to the data collector; including processed design files from the CADD software.

c. CADD and GIS software. Numerous software packages are used to process survey data into a final design or map product. All have various options and capabilities. Bentley and AutoDesk are the most common CADD packages used in the Corps. Each CADD vendor has a variety of optional packages which input survey data for use in a final design application. Examples include AutoDesk Land Desktop, AutoDesk Field Survey, Bentley GEOPAC, AutoDesk CAiCE, TDS ForeSight, Trimble Terramodel, Carlsen SurvCadd XML, AutoDesk Land Development, ESRI Survey Analyst, and Bentley InRoads. Some of these packages simply utilize fully processed and edited data to generate final products. Others have survey editing, adjustment, and COGO options built in, along with final drawing capabilities. Each package is generally tailored to a specific engineering discipline--e.g., CAiCE is used for highway design and construction. Many CADD packages will import field data directly from the data collector. Others are restricted to importing data only in certain formats or from specific data collector models. CADD software display capabilities include 2D and 3D models, sheet layout, contours (Figures 11-2 and 11-3), etc.

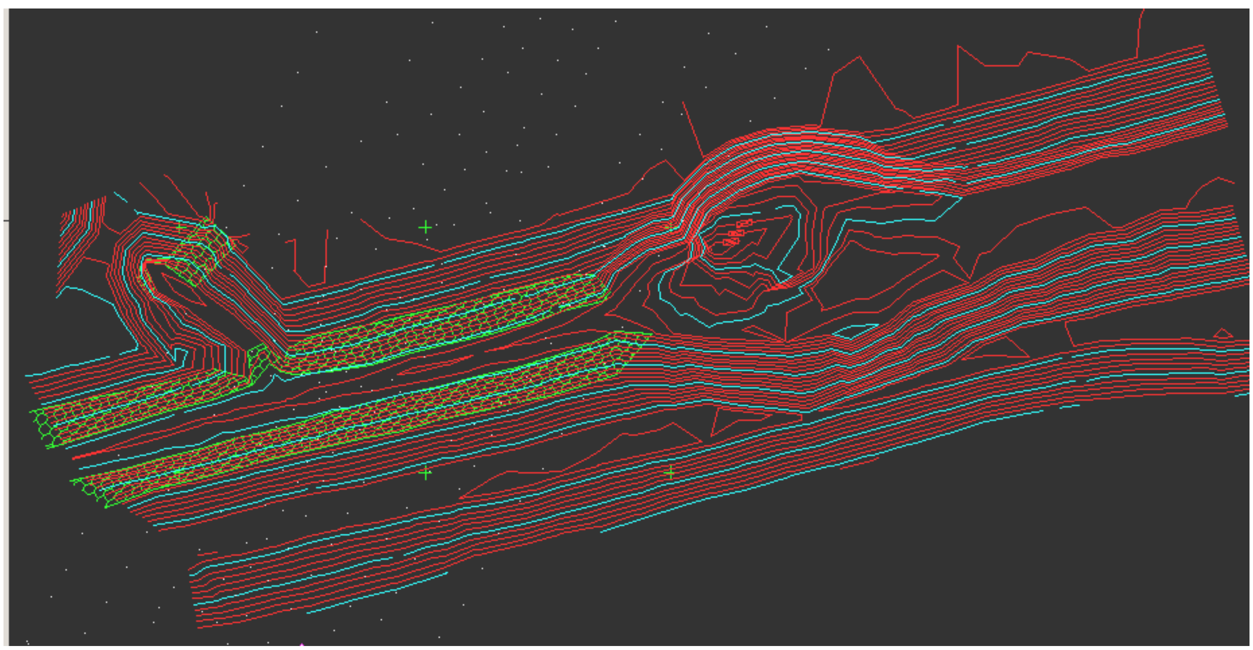


Figure 11-2. MicroStation contour generation from topographic survey of scour erosion site along Sanders Creek, Pat Mayes Lake, Texas (Tulsa District)

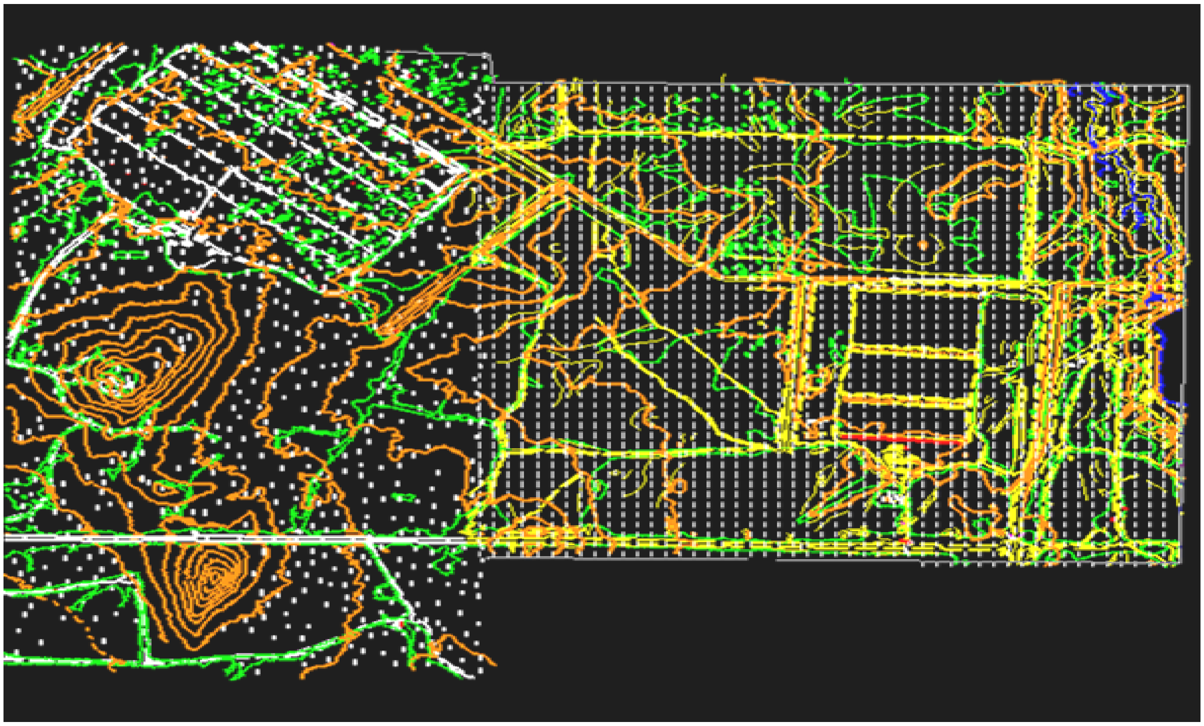


Figure 11-3. MicroStation file Showing Planimetric and Topographic Mapping of 440 acre Range at Fort McCoy (Louisville District)

11-3. Basic Definitions of Geospatial Data used in CADD or GIS Databases

The following subparagraphs detail some of the basic concepts and features required for field-collected topographic data that is exported to a CADD or GIS platform. These include descriptions of data dictionaries, types of feature codes and attributes, methods of feature code collection, and processing features with attributes.

a. Data Dictionary. A Data Dictionary contains the following information:

- Feature and Attribute Library
- Intelligent Features Codes
- Data about Feature Codes

A data dictionary is created using software designed for that purpose. Features and attributes are selected, along with attribute values and expected ranges. The edited data dictionary is uploaded to the data collector. Feature symbols can also be selected for display on the field data collector. The data dictionary software should also have an ability to import a file containing existing GIS table structures or CADD layers and symbols. An example of a Trimble TGO Data Dictionary editor was provided in Chapter 7.

b. Feature Codes. Feature Codes are descriptors identifying some unique property associated with a topographic feature.

c. Cartographic data. Cartographic data are observations (or shots) on spatially distributed features, activities, or events, which are definable as:

- Points
- Lines (Arcs)
- Areas (Polygons)

d. Attributes. Attributes are descriptive information in a database about the cartographic features located on a map. Attributes describe the characteristics of a feature--they are often referred to as non-cartographic data. Attributes can be any numeric or character value that describes the feature. Examples of attributes assigned to a tree might include:

- Height
- Diameter
- Species
- Condition
- Age

e. Attribute Values. Attribute values are sub details given to an attribute. For example, possible values for the attributes of the above Tree feature might include:

- Height = 15m
- Diameter = 0.75m
- Species = Oak
- Condition = Good
- Age = 8 years

When attribute data is collected in the field, the user may be prompted on the data collector when a particular feature is shot. Attribute values can be classified as character, numeric, date, or temporal fields. This prevents the input of an incorrect value into an attribute field; for example, preventing the entry of characters into a numeric field. Attribute range limitations (or domains) are also held in the dictionary to prevent gross blunders in entering attribute data--e.g., a 0.1 ft or 1,500 ft height tree.

f. Point Features. A point feature represents a single geographical location (such as a latitude/longitude and altitude)--see Figure 11-4 below. A point feature type is used to represent a feature that has no length or width. Examples of point features are:

- Tree
- Lamp Post
- Power Pole
- Fire Hydrant
- Manhole

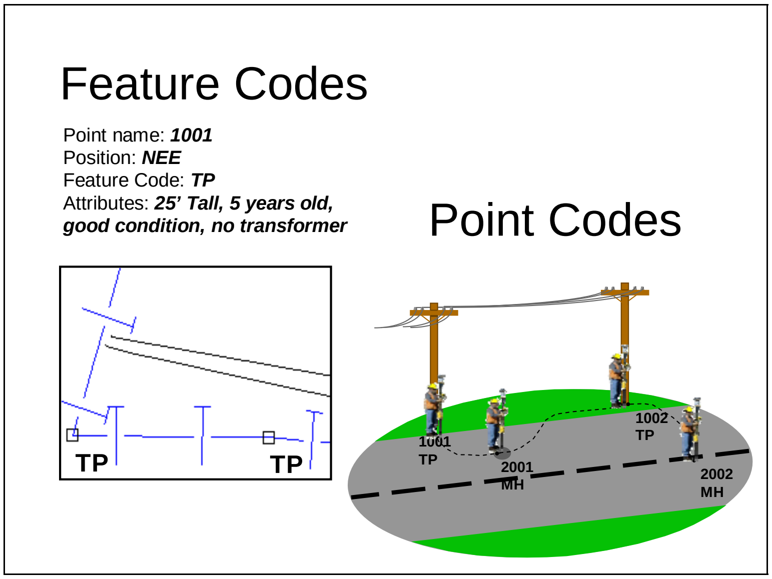


Figure 11-4. Point Codes and Feature Codes (David Evans & Associates)

g. Line Features (breaklines, arcs, strings, or polylines). A GIS line feature type is a series of geographical locations that are connected--so-called "*arc-nodes*." A line feature type is also used to represent a feature which has a length but no width. Some GIS's refer to line features as arcs. CADD software will mathematically define line strings as opposed to connected points in GIS. Breaklines are connected strings, as shown in Figure 11-5 below. Examples of line features are:

- Roads/Railways
- Streams
- Animal trails
- Routes

Line features will have various attributes similar to point features, e.g., storm sewer pipe diameter, type, thickness, date set, etc.

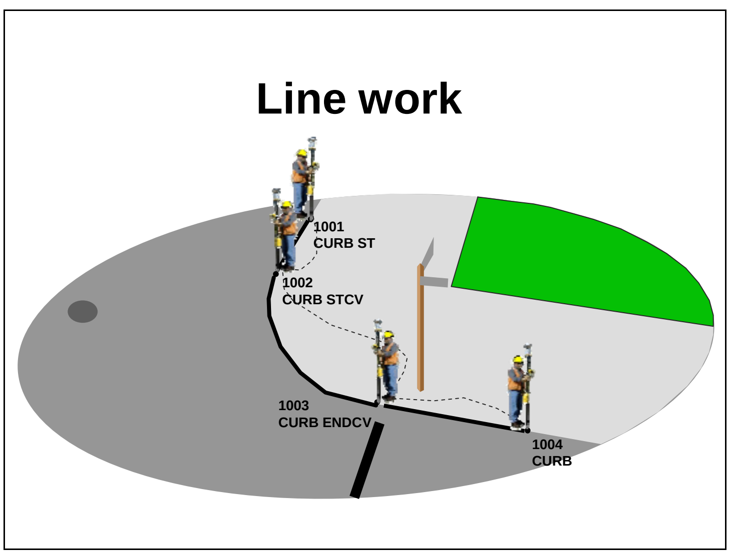


Figure 11-5. Delineating line features (David Evans & Associates)

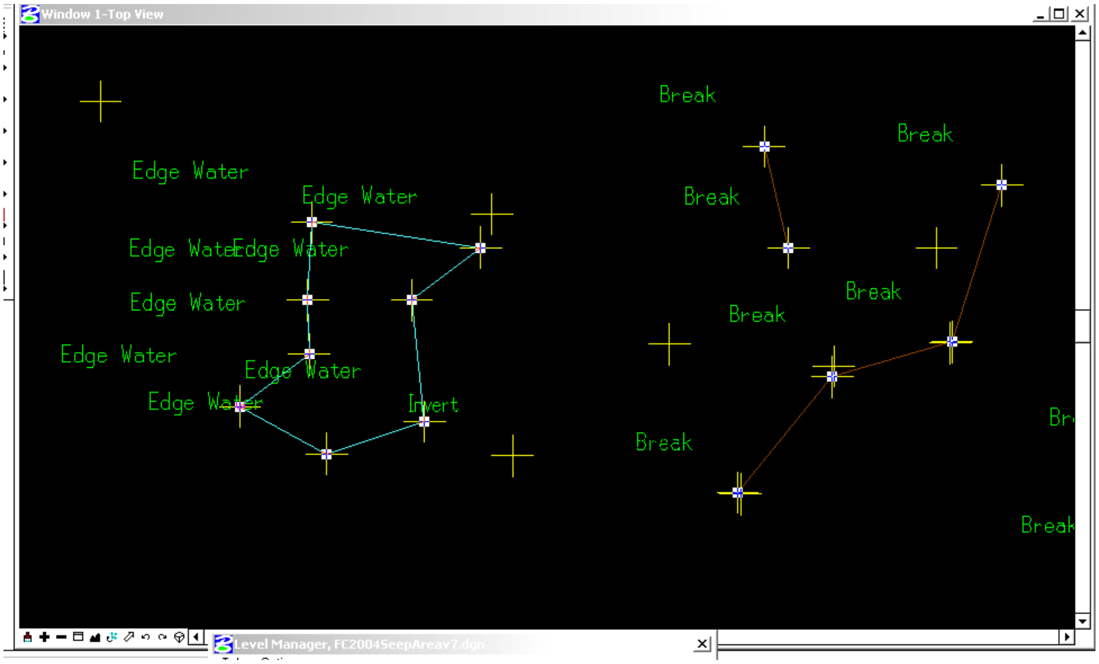


Figure 11-6. Breaklines and connected line features
(Portland District 2004 Survey of Fall Creek Seepage Area)

h. Area Features. Areas (polygons) are a series of geographic coordinates joined together to form a boundary. An area feature type is a closed line. An area feature has a length and a width and can have attribute data. In GIS, area features are referred to as polygons. A polygon is a single arc or a series of arcs that are connected together in order to enclose an area. Examples of area features are:

- Soil types
- Wetlands
- Flooded land
- Lakes
- Parking Lot
- Building
- Soil types

i. ESRI Shapefiles. A GIS shapefile stores nontopological geometry and attribute information for the spatial features in a data set. The geometry for a feature is stored as a shape comprising a set of vector coordinates. Because shapefiles do not have the processing overhead of a topological data structure, they have advantages over other data sources such as faster drawing speed and edit ability. Shapefiles handle single features that overlap or that are noncontiguous. They also typically require less disk space and are easier to read and write. Shapefiles can support point, line, and area features. Area features are represented as closed loop, double-digitized polygons. Attributes are held in a dBASE® format file. Each attribute record has a one-to-one relationship with the associated shape record. Shapefiles are created using various ESRI products (e.g., ArcGIS).

11-4. SDSFIE Data Model

The SDSFIE data model described back in Chapter 2 contains the following element definitions taken from Release 2.300. (See also ERDC/ITL 2002b "*SDSFIE/FMSFIE Data Model and Structure*").

- Entity Sets - Broad grouping for data management
  - *Entity Sets* are the highest level of the SDSFIE data model structure and represent data organized at the project level.
  - *Entity Sets* are broad, generalized themes containing groupings (called Entity Classes) of features (i.e., graphic objects (called Entity Types) which can be depicted at their actual geographic locations on a map) and related "graphic" attribute data (i.e., data (information) about the feature which is stored in a database table).
  - The SDSFIE Release 2.40 structure contains the following twenty-six Entity Sets: (1) Auditory, (2) Boundary, (3) Buildings, (4) Cadastre, (5) Climate, (6) Common, (7) Communications, (8) Cultural, (9) Demographics, (10) Environmental Hazards, (11) Ecology, (12) Fauna, (13) Flora, (14) Future Projects, (15) Geodesy, (16) Geology, (17) Hydrography, (18) Improvements, (19) Landform, (20) Land Status, (21) Military Operations, (22) Olfactory, (23) Soil, (24) Transportation, (25) Utilities, (26) and Visual.

- Entity Classes - Grouping of data within each Entity Set
  - Corresponds to a map file, so it contains CADD layers or levels.
  - The SDSFIE is designed to be CADD/GIS platform independent, which means the standards are designed to work with the *most limiting* of the predominant commercially available CADD/GIS platforms which will be used.

- Entity Types - Grouping of Items that appear graphically on a map or drawing.
  - The logical name of a type or object that can be graphically depicted on a map or drawing.
  - Grouping or collection of like Items (entities) that appear graphically on a map or drawing.
  - Has a corresponding attribute table (database table containing information concerning the entity type).

- Attribute Tables - A relational database table containing non-graphic information, or attribute data.
  - A relational database table containing attribute data.
  - “Graphic” attribute table - linked to a graphic entity, and contains data describing the graphic entity, along with other data and relationships required for geospatial and relational analysis.
  - “Nongraphic” attribute table - contains data and relationships which may be queried for geospatial and relational analysis.

- Domain Tables - Contains lists of “valid” or “permissible” values for specific attributes in an Attribute Table.
  - A relational database table containing lists of permissible values for specific attributes.
  - Provides a finite set of “valid” or “allowable” values, and may be enlarged as necessary.
  - Includes units of measure, materials, methods, dispositions, classes, status, phase, etc.
  - May be either “LIST” or “RANGE”

For additional information on the SDSFIE Model see: https://tsc.wes.army.mil/products/tssds-tsfms/tssds/html/sdsdocin.asp

11-5. Data Collection and Processing Procedures for Topographic Surveys

There is no standard process for moving digital field observations into a CADD platform. The steps taken vary with the type of total station used, including its internal or external data collector. Field data collection procedures can vary from simple single shot points to fully attributed polyline strings. A variety of data formats can be output from the different data collectors on the market. The field data may be imported directly into a CADD package or processed through intermediate survey software before being uploaded into the CADD package, as was illustrated in Figure 11-1 at the beginning of this chapter. Over 50 different survey software and CADD systems are listed in the most recent compilation by POB Magazine (POB 2004c). Given this variety of CADD/survey software, there are numerous methods used to process data from the field to finished CADD or GIS product. Corps districts primarily use either MicroStation or AutoCAD, with MicroStation being more predominant. However, most data collector software is geared more towards export to AutoCAD than MicroStation. The following steps highlight a general process used in most systems. However, the trend today on some total station systems is to develop data on the data collector that imports directly into the CADD platform without all the intervening steps and varied format conversions described below.

Step 1--Observations. In the first step of the process, the field survey vertical and horizontal angles are measured along with slope distances using the total station. The angles and distances are stored with a point number and description in the data collector. Optionally, attribute data may also be stored with each point, including line/area string codes. COGO routines in the data collector may be employed to convert raw observed data to local grid X-Y-Z coordinates; optionally, these conversions may be made on a PC after the data are downloaded. If a RTK system is used, radial X-Y-Z coordinate data for each observed point is attached with a descriptor identifier code and saved in the data collector.

Step 2--Transfer data from data collector to PC. After completing the survey, the data are then transferred to a field or office computer via telephone, cable, or infrared modem for data processing and editing. The computer is either an in-office desktop system or a laptop model that can be used on site. A number of software systems contain modules for performing this data transfer process. Data transfer programs were described back in Chapter 7. One or more files may be downloaded from the data collector. Depending on the data collector software, these downloaded datasets might include:

- Raw data files in ASCII format containing all original survey, project, and attribute observations keyed or processed in the data collector.

- Native binary format of the above file

- Coordinate file containing reduced X-Y-Z-attribute data for each observed point

- Other types of field recorded data may also be downloaded, e.g., pen tablet field sketches and notes, digital photo images, etc.

Step 3--Reformatting. If a coordinate file was not directly generated in the field, then the raw data files must be processed in the computer to produce a coordinate file that contains point number, point code, X-Y-Z coordinate values, and a point descriptor. Survey software packages provide review and edit capabilities at this stage of the processing, checking point codes and descriptors before they are imported into the CADD platform. These software packages are also useful in generating standardized feature and attribute codes which can be uploaded to the data collector to ensure consistent observing methods.

Step 4--Convert data into a graphics design file for use in a CADD program such as MicroStation or AutoCAD. A number of software conversion programs are available to convert raw data collector files into a CADD file. The program CVTPC, available from ERDC, is an example of a program commonly used to convert the ASCII files into 2D or 3D MicroStation design files. Level, label, symbol, and line definitions are assigned to each point based upon a point code. CVTPC can be obtained by linking to ERDC from the USACE home page at http://www.usace.army.mil.

Step 5--CADD specific applications. Once data are contained in the CADD platform, the basic topographic data can be plotted for review and edit. Digital terrain models (DTM) can be generated that can be used to generate contours, quantity take-offs, etc. Final editing and addition of notes are completed, yielding topographic data in a digital format or as a plotted map. Sheet layouts are assigned and the topographic data are ready to be used for their intended engineering, design, planning, or construction function.

As stated previously, many of the above steps can be skipped if field data are collected using procedures, software, and coding that is directly compatible with the final CADD platform. Thus, uniform operating procedures are needed when collecting and processing survey data. The use of proper field procedures is also essential to prevent errors or omissions in generating the final site plan or map products. Collection of survey points in a systematic and meaningful pattern aids in this process. If consistent field procedures are employed, then a minimal amount of post-processing or editing on the CADD platform will be required.

a. Various software/ hardware packages are available to collect and process survey data. Some data collectors are actually PC-based processors that can log total station data and run various survey adjustment software packages. Field PC-based software can perform post-processing and adjustments, and import the data directly into a CADD workstation.

b. When procuring components of a data collection and processing system, compatibility between components and a minimum capability must be assured. Survey coordinates with a descriptor or code to indicate the surveyed feature should be input, as a minimum, to the CADD system. ASCII X-Y-Z or latitude-longitude-height data, along with alphanumeric descriptor data, are usually accepted by CADD software and are commonly output by data collectors or survey processing programs. The CADD program should have some flexibility in the order the coordinates are received (X-Y-Z, Z-X-Y, etc.) and the length of the data records.

c. More complex and sophisticated information, such as contour lines and symbols, can sometimes be passed from survey to CADD programs through common graphic formats, such as DXF. However, note that a 100% reliable transfer of graphic data is not always possible. For example, contour lines passed to a CADD program in DXF format may have isolated breaks or overlap. Transfer of graphic data using proprietary formats is usually most reliable.

d. Transferring data to a field or office PC is a fairly straightforward process and is usually detailed in the operating manuals associated with the data collector software or CADD/GIS software. Field data are often transferred directly into a CADD or GIS software program using import features on that program. Optionally, an ASCII file may be created on the PC that is generic to any CADD/GIS program. These CADD programs can usually import data from a variety of survey systems and data collectors, including generic datafiles.

11-6. Field Computers and Software for Viewing and Processing Data

Many districts perform much of the survey reduction, processing, editing, and adjustment in the field, and are transferring files directly into a CADD package. The greatest advantage of this procedure is uncovering a mistake which can be easily corrected if the crew and equipment are on the site. Laptop and notebook computers are normally used to download GPS and total station data. Once the files are stored in the computer, data processing and plotting in a CADD package can be performed. Data can be viewed and edited in the field before it is sent on to a CADD platform--see Figure 11-7 below.

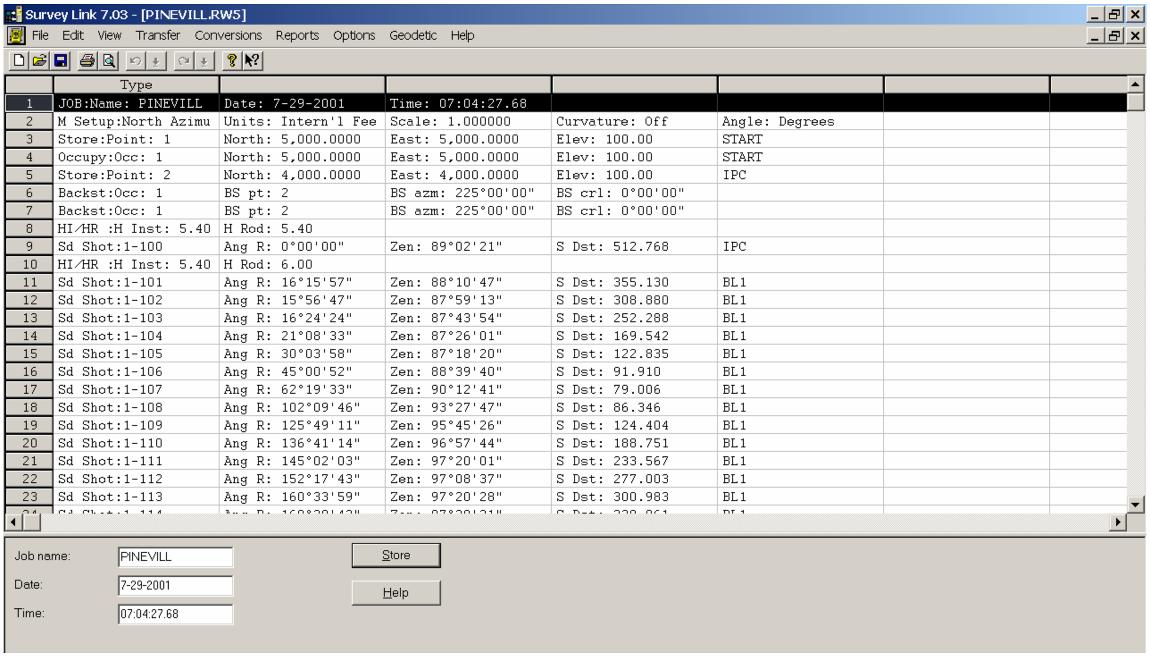


Figure 11-7. Editing total station raw data file in TDS Survey Link 7.03

Listed below are some software considerations to install on field computer systems. Some of these features may also be available on the data collector.

- Interface with field data collector.
- A system of predefined codes for most common objects and operations in a database.
- User-defined codes for site-specific requirements in a database.
- Survey adjustment programs such as:

    Compass rule adjustment
    Transit rule adjustment
    Crandall method
    Least squares
    Angle adjustment
    Distance adjustment

- Include a program which can assign an alphanumeric descriptor field for each survey point.
- Include a full-screen editor to examine and edit ASCII data files.
- Have an interface program to convert files to common graphic interchange formats such as IGES or DXF.
- A program to connect features which were not recorded in order such as fence, curb and gutter, edge of pavement, waterline etc.
- Provide an operating system which will be compatible with post-processing machines with CADD programs such as MicroStation or AutoCAD.
- Custom programs which can use all the features available to the total station or the data collector.
- Select software which provides training if possible.

11-7. Field Quality Control and Quality Assurance Checks

a. Backups. Upon the completion of the file transfer, make a backup copy of the raw data. Once this transfer is complete, and only after this transfer is complete, then the data in the data collector can be deleted.

b. Hard copy prints. Print a copy of the formatted data and check it against the field notes. Check the field input of data against the field notes. Specifically, check the instrument locations, azimuths to backsights, and the elevation of benchmarks. Also scan the data for any information that seems to be out of order. Check rod heights.

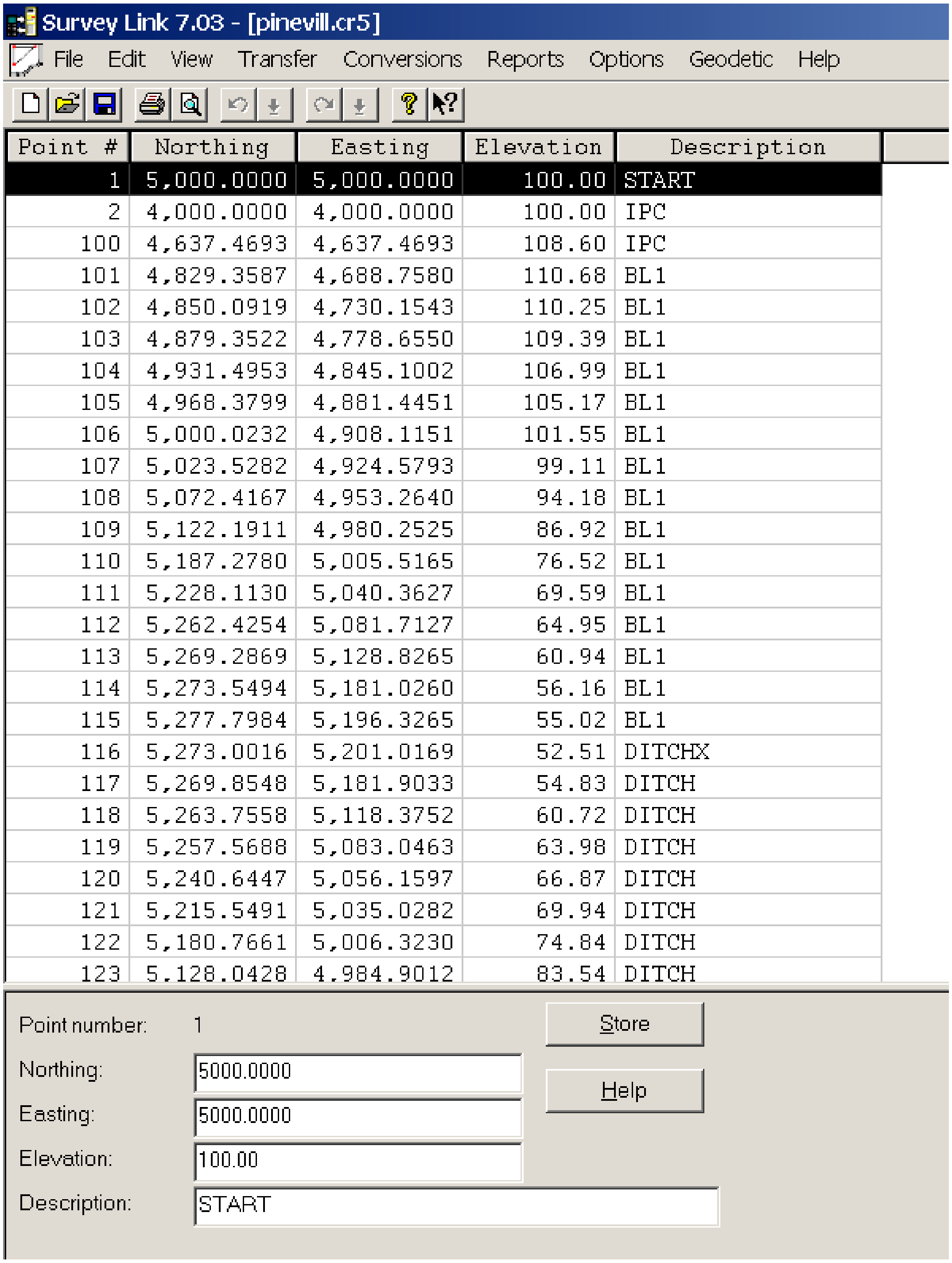
c. Edit the data. Eliminate any information that was flagged in the field as being in error. In the system, make a record of any edits, insertions, deletions, who made them, and when they were made.

d. Process the control data. Produce a short report of the data that were collected in the field. Check the benchmark elevation to be certain that the given elevation is the calculated elevation and that the coordinates of the backsights and foresights are correct.

e. Data quality. To assure that complete data are being supplied by the field, make certain that the field crew fully understands the automated processes that are being used and that they take care to gather data appropriately. It is much easier and more productive for the field crew to get a few extra shots where they know there will be difficulty in generating a good contour map than it will be for those in the office to determine where certain shots should have been made and add them to the database. The field crew must also make sure they pick up all breaklines necessary to produce the final map.

f. Terrain contouring. The field crew will need to become educated about the contouring package used by the District Office. As the data are brought in from the first few projects, and periodically thereafter, the crew should observe the product produced by the contouring program. This will help them to understand where and what amount of data may be needed to get the best results. The District Office staff needs to be aware that in some circumstances the field crew may have difficulty in getting some information (terrain restrictions, traffic, etc.).

g. Field edit. The person responsible for the field work should be involved in the initial phase of editing because he or she will most likely remember what took place. Preferably, the editing should be done the same day the data are gathered, while the field person's memory is still fresh. If it is not possible for someone to walk the site to ensure that the final map matches the actual conditions, then the field person should be the one to review the map. Figure 11-8 shows one example by which processed data can be checked for quality.



Point #	Northing	Easting	Elevation	Description
1	5,000.0000	5,000.0000	100.00	START
2	4,000.0000	4,000.0000	100.00	IPC
100	4,637.4693	4,637.4693	108.60	IPC
101	4,829.3587	4,688.7580	110.68	BL1
102	4,850.0919	4,730.1543	110.25	BL1
103	4,879.3522	4,778.6550	109.39	BL1
104	4,931.4953	4,845.1002	106.99	BL1
105	4,968.3799	4,881.4451	105.17	BL1
106	5,000.0232	4,908.1151	101.55	BL1
107	5,023.5282	4,924.5793	99.11	BL1
108	5,072.4167	4,953.2640	94.18	BL1
109	5,122.1911	4,980.2525	86.92	BL1
110	5,187.2780	5,005.5165	76.52	BL1
111	5,228.1130	5,040.3627	69.59	BL1
112	5,262.4254	5,081.7127	64.95	BL1
113	5,269.2869	5,128.8265	60.94	BL1
114	5,273.5494	5,181.0260	56.16	BL1
115	5,277.7984	5,196.3265	55.02	BL1
116	5,273.0016	5,201.0169	52.51	DITCHX
117	5,269.8548	5,181.9033	54.83	DITCH
118	5,263.7558	5,118.3752	60.72	DITCH
119	5,257.5688	5,083.0463	63.98	DITCH
120	5,240.6447	5,056.1597	66.87	DITCH
121	5,215.5491	5,035.0282	69.94	DITCH
122	5,180.7661	5,006.3230	74.84	DITCH
123	5,128.0428	4,984.9012	83.54	DITCH

Figure 11-8. Reviewing final X-Y-Z coordinate files (Survey Link 7.03)

Figure 11-9 below depicts feature and attribute assignments on one of the objects ("FH" -- fire hydrant) that were imported into a Trimble Geomatics Office (TGO) software display.

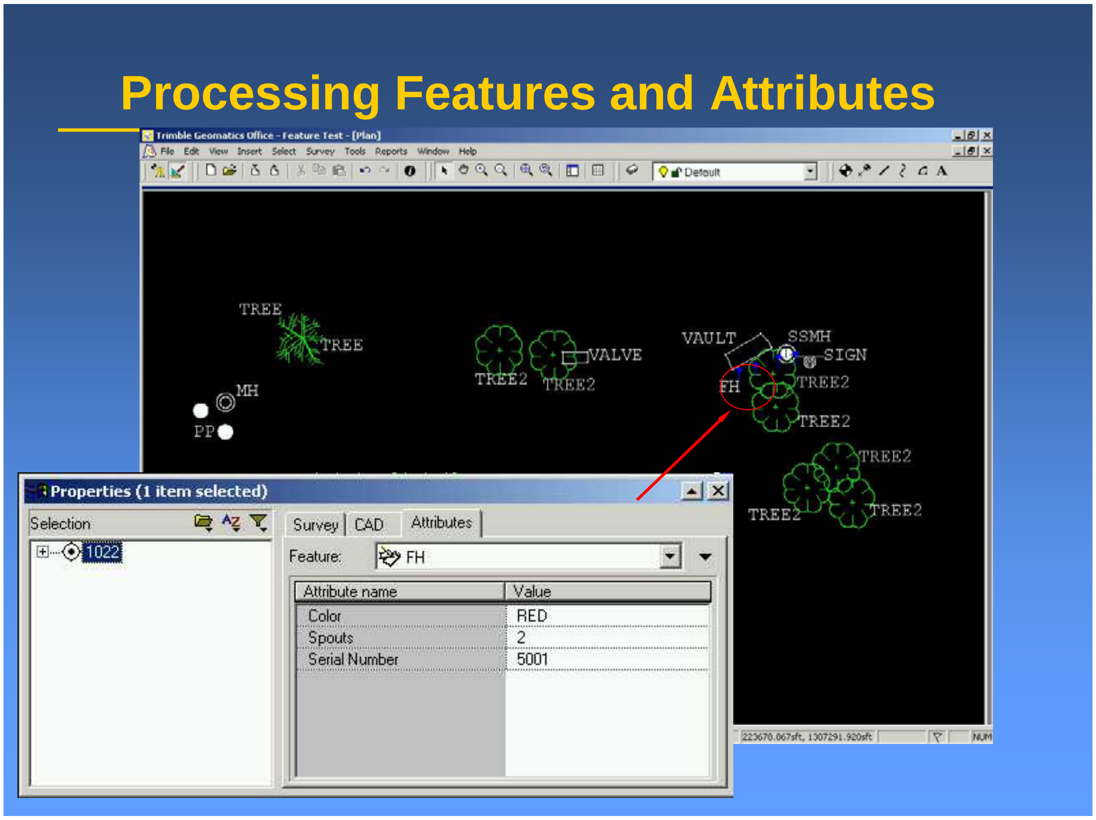


Figure 11-9. Feature and attribute coding--Trimble Geomatics Office (David Evans & Associates)

11-8. Cell Libraries Containing Corps of Engineers Standardized Symbology

A "cell" in MicroStation and a "block" in AutoCAD are groups of graphical elements that can be manipulated as a single entity. Examples of cells/blocks are hydrants, poles, benchmarks, etc. The use of such symbology enhances CADD productivity and provides an excellent opportunity for CADD standardization. MicroStation cells are contained in cell libraries (.cel) and custom line styles contained in resource files (.rsc). AutoCAD blocks are in an individual drawing (.dwg) file, patterns in a pattern library file (.pat), multilines in a multiline library file (.mln), and custom line styles in a line type library file (.lin).

a. Graphical presentations of the entire symbology library are shown in Appendix D of the A/E/C CADD Standard. The symbology library contains four types of elements: Lines, Patterns, Symbols, and Objects. Lines are defined as a graphical representation of linear drawing features (e.g., utility lines, fence lines, contours). Patterns are defined as repeated drawing elements (e.g., lines, dots, circles) within a defined area. Symbols are defined as MicroStation cells or AutoCAD blocks that are representative of objects (e.g., electrical outlets, smoke detectors). Objects are defined as MicroStation cells or AutoCAD blocks that retain their actual size no matter the scale of the drawing.

b. Figure 11-10 below depicts a portion of the surveying and mapping symbols published in the CADD/GIS Technology Center "*A/E/C CADD Standard*"--ERDC/ITL TR-01-6 (Appendix D--Symbology).

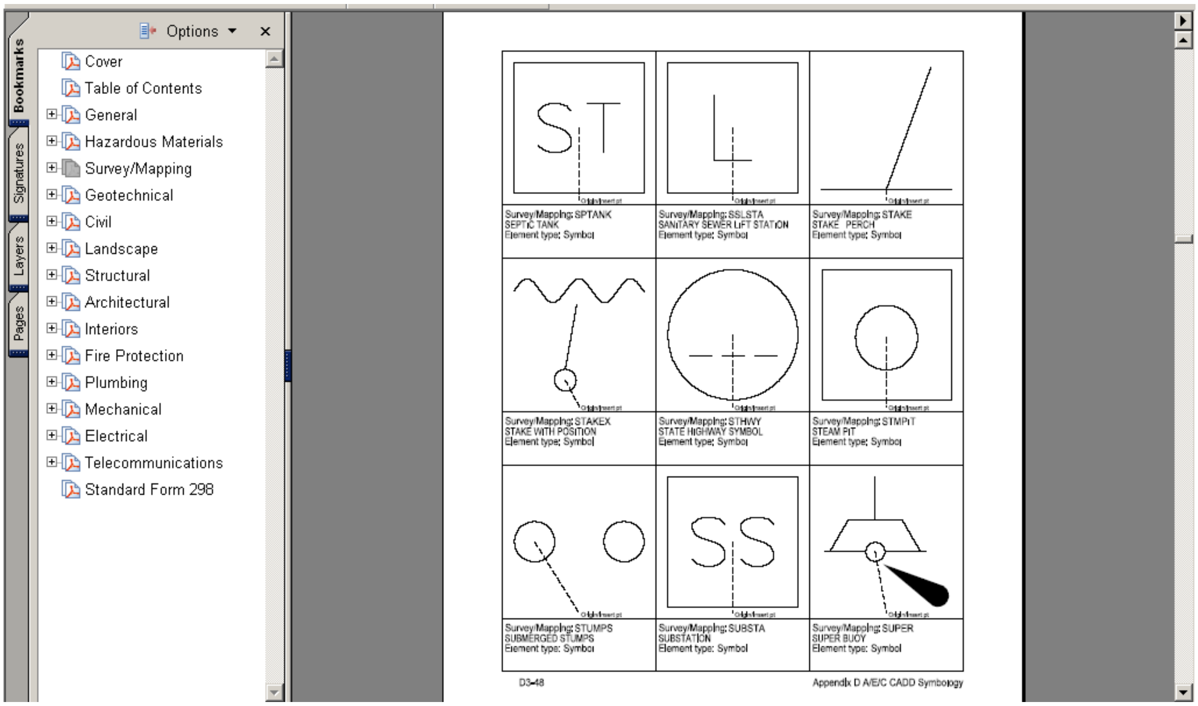


Figure 11-10. Portion of A/E/C CADD Standard surveying and mapping symbology listing

11-9. Sheet and Model Files

A model file contains the physical components of a building (e.g., columns, walls, windows, ductwork, piping, etc.). Model files are drawn at full scale and typically represent plans, elevations, sections, etc. A sheet file is synonymous with a plotted CADD drawing file. A sheet file is a selected view or portion of the model file(s) within a border sheet. A sheet file is a view or portion of an assembly of referenced model files plus additional sheet-specific information (e.g., north arrows, scales, section cuts, title block information). A sheet file is the final project sheet, which is a “ready-to-plot” CADD file within a border sheet and is usually plotted at a particular scale, since the border sheet is scaled up to fit around the full-scale model files.

11-10. Reference Files

Reference files (external references or XREFs) enable designers to share drawing information electronically, eliminating the need to exchange hard copy drawings between the design disciplines. With the use of reference files, the structural engineer need not wait for the architect to complete the architectural floor plans before beginning the structural framing plan model file. Nor does the engineer have to redraw the architect’s structural walls on the structural framing plan model file. Referencing electronic drawing information makes any future changes made by the architect apparent to the structural designer. This real-time access to the work of others ensures accuracy and consistency within a set of drawings and helps promote concurrent design efforts. No longer does one discipline have to wait until another discipline is nearly finished before they begin their drawings. The use of reference files is a key component in the successful use of the level/layer assignments. To create either a model file or a final sheet file, multiple referenced model files may be required.

11-11. Level Assignments for Surveying and Mapping

The following table depicts the "standard" 63 level assignments used for surveying & mapping features in many Districts of the Corps of Engineers.

Level	Description	Color	Weight	Line Code
1	Sheet Dependant Information			
2	Coordinate Grid/ Neat Box / N. Arrow	2	0	0
3	Coordinate Grid / Annotation	2	0	0
4	Buildings	4	2	0
5	Building Annotation	4	0	0
6	Centerline	3	0	4
7	Road, Railroad and Centerline Annotation	4	0	0
8	Roads, Parking Lots, Walks, Railroads, and Trails	4	1	
9	Concrete Joint Layout	4	0	0
10	Concrete Joint Elevations	4	0	0
11	Runway, Taxiway, and Aprons	5	1	0
12	Runway Annotation	5	0	0
13	Pavement Markings and Signs	5	0	0
14	Structures and Headwalls	6	1	0
15	Structure Annotation	6	0	0
16	Culverts	6	1	0
17	Culvert Annotation	4	0	0
18	Riprap	2	1	0
19	Water Features	1	0	0
20	Water Feature Annotation	1	5	0
21	Vegetation	2	0	0
22	Vegetation Annotation	2	0	0
23	Fences, Guard Rails	1	0	0
24	Fence Annotation	1	0	0
25	Boundary Lines / Cadastral-R/W	6	2	0
26	Boundary Lines / Cadastral / Annotation	6	0	0
27	Survey Control Points, Baselines	5	1	0
28	Survey Control Points / Azimuths	5	0	0
29	Breaklines	4	0	0
30	Spot Elevation	4	0	0
31	Major Contours	6	2	0
32	Contour Annotation	6	0	0
33	Minor Contours	3	0	0
34	Bores, Holes, and Text	6	0	0
35	Storm Sewerlines and Manholes	2	0	0
36	Storm Sewer Annotation	2	0	0
37	Sanitary Sewerlines, and Manholes	4	0	0
38	Sanitary Annotation	4	0	0
39	Water Lines, Fire Hydrants, and Water Tanks	1	0	0
40	Waterline Annotation	1	0	0
41	Gaslines, Features, and Valves	3	0	0
42	Gasline Annotation	3	0	0
43	Powerlines, Lights, and Telephone Poles	5	0	2
44	Powerline Annotation	5	0	0
45	Steamlines, Features, and Valves	6	0	0
46	Steamline Annotation	6	0	0
47	Cross Sections and Profiles	4	0	0
48	Details, Inserts		0	0
49	Soundings	1	0	0
50	Channel Lines, Disposal Areas	3	5	3
51	Channel Line Annotation		5	0
52	Navigation Aides and Annotation	6	1	0
53	Levees, Dikes, and Annotation	4	1	0
54	Pipe Lines, Structures, and Bridges	6	1	0
55	Pipe Line Annotation	6	0	0
56	Stationing and Ranges	5	1	0
57	Revetments and Annotation	2	0	0
58	Match Lines	3	1	0
59	Match Line Annotation	3	5	0
60	Unassigned			
61	Unassigned	3	2	0
62	Unassigned			
63	Unassigned			